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THE ETHER OF SPACE.

The Ether of Space. By Sir Oliver Lodge, F.R.S.
Pp. xvi+156. (London: Harper and Bros., 1909.)
Price 2s. 6d. net.

THIS book is a contribution to what the publishers describe as a "Library of Living Thought." In appealing to Sir Oliver Lodge for a book on the ether they could count on getting something which could certainly be called "thought," in the most exalted sense of the word, and would as certainly be alive. But, notwithstanding the many picturesque images with which the theme is illustrated, we must confess that we have found the book as a whole somewhat unsatisfactory. This is perhaps due to a certain indefiniteness of aim; some sections would seem to be addressed to the cultivated *dilettante*, and dwell at great length on very elementary matters, whilst others can hardly be appreciated except by the expert who is already conversant with the more abstruse parts of electrical and optical theory. Thus the primary notions of aberration are expounded very fully, whilst the theories of Michelson's experiments and of Fresnel's law of wave-velocity in a moving substance are treated with tantalising brevity. Again, the mechanical and optical details of the author's own experiments with the "ether machine" are given with a minuteness which in a work on the present scale rather tends to distract attention from the main point.

The ether has in its not very lengthy history undergone many transformations. The unsatisfactory elastic-solid medium of the last century, with its abundant provision for the explanation of non-existent phenomena, has at length gone, to the general relief. But the newer ether which is gradually being evolved in its place, with its ability to exercise force, and, at the same time, its utter indifference to forces exerted on itself, appears somewhat shadowy and mysterious. When the conceptions are resolved into their elements we are left with little more than what the mathematicians call a "vector-field." It might seem, indeed, that the physicist had only to take one step more, and hand over the whole medium, as a pure abstraction, to the mathematician, who, for his part, is disposed to welcome the gift with enthusiasm as affording, after a few improvements, an unexpected outlet for the theory of groups. His one regret is that he did not (as he confesses he ought to have done) invent the whole thing for himself.

Sir Oliver Lodge, like Lorentz, comes to the brink, but he will not take the plunge. The most interesting parts of this book are those in which he explains the lengths to which he is prepared to go in the effort to retain a mechanical basis for phenomena. He admits, indeed, that ordinary matter is an imposture, but he clings resolutely to something very real and very substantial in the background. He reproduces his recent arguments to show that if the inertia of the atoms of ordinary matter is merely the manifestation of that of a surrounding medium, the density which it is necessary to attribute to the

latter is something like 10^{12} that of water. This seems at first sight like a nightmare, but it is in no sense incredible. Waiving details which can have no great influence on the result, it is, indeed, from the author's point of view, mathematically incontestable. He goes on to speculate on the origin of the forces which this medium can exert. Assuming a kinetic theory of force as the only one ultimately acceptable, he sums up his conclusions in a sort of anthem:—

"Every cubic millimetre of the universal ether of space must possess the equivalent of a thousand tons, and every part of it must be squirming internally with the velocity of light."

It will be seen that the book is in substance a restatement of the author's most recent speculations, in which, of course, he stands by no means alone. If it somehow fails to do full justice to these, and if in some respects the original papers in the *Philosophical Magazine* and elsewhere will probably be found by many to be really easier reading, the auspices under which it is brought out are no doubt partly accountable. The general reader, even if he is disposed to take most things on trust, and does not adopt the critical attitude which the author would himself welcome, will at all events learn to understand the admiration which the scientific world feels for the genius and unflagging spirit with which a most difficult as well as stupendous theme is repeatedly essayed.

H. L.

NEW METHODS OF WEATHER FORECASTING.

Nouvelle Méthode de Préviation du Temps. By Gabriel Guilbert. Pp. xxxviii+343. (Paris: Gauthier-Villars, 1909.)

MONSIEUR GABRIEL GUILBERT, the winner of the prize offered in 1905 by the Société belge d'Astronomie, de Météorologie et de Physique du Globe, for the most successful short-period forecasts of weather, has published in book-form a detailed exposition of the principles underlying his method. He introduces two new principles into the art of weather forecasting, which, so far as we are aware, have not been stated explicitly by any other writer on this subject. First, he invites us to compare the force of the wind at the surface as observed at the various stations contributing to our daily weather reports with the barometric gradient at sea-level. If in any region the observed wind forces are markedly in excess of the normal for the prevailing gradient, a surge of high pressure in the direction of the gradient may be looked for, and *vice versa*. His definition of the word "normal" is entirely conventional. It is based on comparisons made by Clement Ley, Sprung, Köppen, and others, and is that the number expressing the wind force on the Beaufort scale shall be twice that expressing the gradient in millimetres of mercury per degree (111 km.). It follows from this general principle that a depression which is surrounded on all sides by winds in excess of the normal will fill up, whereas a depression surrounded by winds in defect will grow deeper. If the defect is great, a depression of small intensity will develop into a violent storm

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centre. A depression round which the distribution of wind force as compared with the prevailing gradient is unsymmetrical will move towards the region of "least resistance," i.e. the region where the winds are most conspicuously in defect. In identifying the region of least resistance the second principle is also used. It is based on the conception of "divergent" winds. Any wind which has a component directed away from a centre of low pressure is divergent for that centre, and as such marks a region of low resistance to its advance. Generally speaking, the greater the "divergence" the less the "resistance." Strong northerly or north-westerly winds to the eastward of a depression are looked upon as an extreme case of divergence, and as a sure sign of a rapid advance of the depression.

M. Guilbert proceeds to elaborate no fewer than twenty-five rules for forecasting which for the most part follow more or less directly from the two fundamental principles. Their application is illustrated by a large number of examples, taken mostly from cases when the forecasts issued by the Bureau at Paris proved incorrect.

So far as M. Guilbert is concerned, both principles must be looked upon as a direct result of the careful scrutiny of weather maps; they are entirely empirical, and no attempt is made to justify them from general dynamical considerations. Since the book has been in our hands, we have watched the charts published in the Daily Weather Report, and have noticed occasions on which the application of the first principle would apparently have been useful. On other occasions we have found difficulty in applying the rule. On many maps there are, within one and the same meteorological region, winds which are, some in excess, others in defect, of the normal. M. Guilbert gives no instructions as to how to proceed in such cases.

The principle of the "divergent" wind is not likely to be accepted without qualification in the form in which it is put forward. M. Guilbert insists very strongly that a single conspicuously divergent surface wind (observations on mountains or at high levels are expressly ruled out as not being comparable with the surface gradient) must be regarded as an almost infallible indication of the early advance of a depression. Objections based on the argument that surface winds are very liable to be influenced by local conditions are brushed aside. Among the examples quoted in the book there are many instances of surprisingly daring and successful predictions, some apparently *ex post facto*, others attested by stamped post-cards as being genuine forecasts made before the event. We are, however, entitled to ask whether the rules might not lead to equally daring but unsuccessful forecasts? Nearly 100 examples are quoted; the number is large, but so is the number of charts from which the selection is made, and it is to be supposed that M. Guilbert, whose style often suggests counsel's address to the jury rather than the judge's summing up, has picked out the cases which best illustrate his points. No doubt he could produce many more instances if called upon to do so, but the multiplication of selected examples does not carry conviction.

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Before passing judgment we must hear counsel for the other side, who may be able to bring forward a similar number of cases at variance with the principles advanced. M. Guilbert has run up against the old difficulty of expressing his hypothesis in such a manner that it can be tested by an appeal to measurement. The relation between the observed wind velocity and the gradient should lend itself to numerical treatment, seeing that both quantities are the object of regular observation and measurement.

The book is accompanied by a preface by Prof. Bernard Brunhes, the director of the observatory on the Puy de Dôme, who acted as reporter on the occasion of the competition at Liège. In a supplement M. Brunhes points out that M. Guilbert's rules are consistent with the results deduced by Lord Kelvin and Bjerknes for the action of a steady current on a vortex, and describes some laboratory experiments of his own illustrating the phenomena.

MEDICAL EMBRYOLOGY.

Text-book of Embryology. By Dr. Frederick R. Bailey and Adam M. Miller. Pp. xvi+672. (London: J. and A. Churchill, 1909.) Price 21s. net.

THIS bulky volume is the third American text-book of embryology that has appeared in recent years. Like Prof. Heisler's work, of which a revised edition was published two years ago, it is addressed primarily to students of medicine and anatomy, being, in fact, based upon the course in embryology given at the medical school of Columbia University. Consequently it differs in its style of treatment from Prof. Lillie's "Development of the Chick," which is apparently intended for zoological students beginning embryology; and whereas Prof. Lillie confines his attention almost exclusively to a single type, and never passes outside the class Aves, the authors of the present volume, although dealing more particularly with human development, have aimed at treating the subject from a comparative standpoint, believing this to be the most efficient way of teaching it. With this opinion most teachers of biology must surely concur. It is satisfactory to note also that the physiology of the developmental processes is not entirely passed over. Thus, in an excellent chapter on the nervous system contributed to this volume by Dr. Oliver S. Strong, the author has been able to include much physiological matter which usually finds no place in a text-book of embryology.

In the second chapter a section is devoted to ovulation and menstruation and the relation which subsists between these processes, but it is to be regretted that the comparative method which is so successfully followed in other parts of the work is not extended to the problems dealt with here. That menstruation in the Primates is the physiological homologue of the proöstrum in the lower Mammalia, and that in the latter ovulation occurs normally during oöstrus, are now generally accepted facts, the recognition of which has removed many apparent difficulties which used to perplex the older writers.